COLONISATION OF SEEDLING ACACIAS BY ARTHROPODS IN SOUTHERN VICTORIA

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Abstract

Seedling acacias of 21 species were monitored for 18 months of field growth and the arthropods present were collected and counted. 165 species of arthropods were found, the most numerous group being spiders (60 spp.), and many of the phytophagous insects characteristic of mature acacias became established during this period. The data are briefly discussed in relation to the insect communities characteristic of mature acacias in the same area.

Introduction

Many Australian species of *Acacia* Miller support large complexes of insects and other arthropods and, although young trees may be severely defoliated by insects, there is little information available on the development of these consumer communities. This paper presents preliminary information on the initial stages of arthropod colonisation of seedling acacias. A mixed plot of 21 species of *Acacia*, established by planting seedlings in an area of mown meadow on the La Trobe University campus in mid-1976, was used to monitor the arthropods present on the plants during their first year and a half of field growth. Although the plot was established primarily for other purposes, and the different numbers of individuals of the various acacias render comparative data on the communities of different 'hosts' of limited value, the information obtained appears to be the first quantitative assessment of arthropod diversity on young acacias in Australia.

Another leguminous shrub, broom [*Sarothamnus scoparius* (L.) Wimmer], in Britain has a life span comparable with that of some acacias and also supports many insect species (Waloff 1968a). Most of the insects characteristic of broom colonise it within the first two years of growth (Waloff 1968b). Different species of *Acacia* when mature sometimes support markedly different numbers of insect species (New 1979: Coleoptera), and characteristic feeding guilds may be present. Foliage-mining Lepidoptera, for example, do not occur on bipinnate acacias. An aim of the present survey was to determine whether some guilds (necessarily, those not dependent on reproductive structures) develop on young trees, or whether the more characteristic insect complements of particular *Acacia* species appear only in later life.

Study area and methods

The area used, an almost level region on the north of the La Trobe University campus, was mown and cultivated before planting the trees in mid-1976. Seedling acacias, obtained from either the university nursery or the Forests Commission Victoria nursery at Mt. Macedon, were searched individually and any insects were removed. These consumer-free seedlings were planted on a 3 x 3 m grid with a larger space between adjacent subplots, and 169 selected trees were inspected monthly for 18 months. During this

period the plot was not tended other than for clipping grass away from the base of any overgrown tree during the first six months and mowing between rows on two later occasions. Mature acacias of several species (but not of all those represented as seedlings), which were possible sources of phytophagous colonisers, were present within a few hundred metres of the plantation. Both acacias endemic to the area and species introduced from elsewhere in Australia were present in the plot and elsewhere in its vicinity.

On each sampling occasion, two people searched the tree directly for all arthropods, and bushier trees were shaken over a beating tray immediately after such examination. Where possible, insects flying off were noted and most other arthropods were removed and brought to the laboratory for examination; exceptions are Coccoidea, Psyllidae, Membracidae and Formicidae, for which representatives were collected to confirm recognition and numbers assessed as 'few' (10 or less), medium (11-50) or 'many' (>50). Heights of trees were noted on each sampling occasion, together with their general condition.

Results

A number of the acacias suffered considerable damage from defoliation during the sampling period, but others appeared almost unaffected by consumers. When planted, the trees were mostly 40-100 cm tall, but some were smaller. At the end of this survey, the largest trees were well under 2 m in height, and the average height increase over the 18 months period was 45.4 ± 32.2 cm. Many trees were thus submerged in the surrounding grass for parts of the period.

Altogether, some 165 species of arthropods were found, many being of only casual occurrence (Table 1). Other than for Homoptera and Formicidae, many were present in only small numbers and on only some tree species (Table 2). The more abundant groups and feeding guilds are as follows:

(a) Arachnida

Spiders were the most diverse group collected, and about 600 individuals, representing 60 species, were found. They occurred on all species of *Acacia.* Blyth (1973) compared the spider fauna of uncut grassland and of 5-8 m high *A. dealbata* in a site close to the present plot. During a seven month study, he collected 47 species from *A. dealbata* and 76 from grassland, with a Sorenson index of K = 0.28*. Most individuals on *A. dealbata* were web-spinners, whereas in grassland a higher proportion of 'hunters' was captured. As in Blyth's study, Argiopidae were the most diverse family on acacias, and Theridiidae, Salticidae, Thomisidae and Clubionidae were also well-represented.

(b) Predatory insects

These were, in general, relatively scarce. The most abundant was the green mantis *Orthodera ministralis* (F.), of which egg cases were also found.

* This index, the quotient of similarity, is given by $\frac{2j}{a+b}$ where j = number of species found in both habitats (A & B) and a and b are the numbers of species found in habitats A & B.

TABLE 1. Incidence and abundance of arthropods on seedling acacias, La Trobe University, 1976-78.

Species	No. trees	Arthropods No.*	Arthropods Species	Phytophagous spp specific to *Acacia*	Number of species of Araneae	Coleoptera	Lepidoptera
acinacea	5	14	12	3	7	1	1
armata	5	18	11	3	6	–	–
botryocephala	5	13	10	4	5	1	2
buxifolia	5	43	9	5	2	–	3
decurrens	6	41	16	9	1	3	4
floribunda	13	177	31	14	3	7	3
hakeoides	5	24	11	5	3	1	3
mearnsii	12	87	28	13	8	4	4
melanoxylon	25	720	90	25	37	17	12
mitchelli	5	21	11	3	7	2	–
mucronata	5	95	21	10	6	3	4
myrtifolia	5	11	9	3	5	1	–
obliquinervia	5	119	41	15	17	5	8
podalyriifolia	12	103	35	11	13	2	4
pravissima	5	159	27	12	10	3	4
pycnantha	26	615	87	31	30	22	12
retinodes	5	181	37	14	14	6	6
saligna	5	38	14	7	2	–	2
stricta	5	258	16	6	7	–	2
suaveolens	5	28	11	4	3	2	1
verticillata	5	47	29	9	13	2	3

* Total of individuals, excluding Formicidae and Homoptera: Coccoidea, Psylloidea, Membracidae.

TABLE 2. Arthropods collected from seedling acacias, La Trobe University, 1976-78.

Group		Total no. (N)	No. species (S)	No. 'host' species (maximum 21)	N/S
Araneae		572	60	21	9.53
Coleoptera		266	32	17	8.31
Lepidoptera –	larvae†	222	16	18	13.88
	adults†	33	6	8	5.50
Heteroptera		30	6	9	5.00
Aphidoidea		33	2	8	16.50
Coccoidea			3	15	
Psylloidea			3	10	
Membracidae			2	21	
Hymenoptera –	Formicidae		6	19	
	others	27	17	9	1.59
Diptera		196	12	15	16.33
Neuroptera		6	2	4	3.00
Dermaptera		3	1	3	3.00
Orthoptera		3	2	3	1.50
Mantodea		35	1	7	35.00
Immature stages† –	eggs*	497	12	16	41.42
	larvae‡	36	5	9	7.20
	pupae	50	10	13	5.00

† Overlap between species assessed in totals given in Table 1.
* Egg batches, egg sacs, oothecae each counted as 1.
‡ Excluding Lepidoptera.

This species is common on larger acacias in Victoria, but is also frequently captured in grassland and on other trees and shrubs. A few adult Neuroptera: Chrysopidae (*Chrysopa edwardsi* Banks, *ramburi* Schneider) were captured, as well as larvae of both these species. Hatched chrysopid eggs were found on several trees but no Hemerobiidae were seen, although two species are common on larger trees nearby.

Single specimens of a syrphid larva and a coccinellid larva were found, as well as adults of *Lemidea subaenea* Mulsant (Cleridae), *Diomous* spp and *Coccinella repanda* Thunberg (Coccinellidae). *Lemidea* may be a regular predator of *Acacia* psyllids (New 1978), *Diomous* are common on larger acacias and *C. repanda* is relatively scarce in the area: only one specimen was found in an extensive survey of *Acacia* Coleoptera in a nearby plot (New 1979). Two species of Hemiptera: Pentatomidae and one of Miridae known to be partially predatory were captured in small numbers.

(c) Phytophagous insects usually associated with *Acacia*

(i) Lepidoptera. The most common larvae found were of three polyphagous moths, *Teia* (= *Orgyia*) *anartoides* (Walker) (Lymantriidae), *Epiphyas postvittana* (Walker) (Tortricidae) and *Digglesia australasiae* (F.) (Lasiocampidae). Several species of Geometridae more closely associated with *Acacia* were also represented, and several phyllodinous acacias were mined by Gracillariidae or Cosmopterygidae. These attacked the first-formed phyllodes of several individuals of *A. melanoxylon, A. pycnantha* and *A. obliquinervia.* Adults found were all of species represented also as larvae, with the single exception of a resting *Pieris rapae* L.

(ii) Homoptera. All species found are believed to be specific to *Acacia.* They include the colonial *Pseudococcus acaciae* (Maskell), three species of Psyllidae and the common membracid *Sextius virescens* (Fairmaire). All occurred in relatively large numbers on many host species and *Pseudococcus* and *Sextius* were usually tended by numerous ants. Psyllidae were found on young flush growth of their hosts.

(iii) Coleoptera. Twenty four species of phytophagous Coleoptera, mainly Chrysomelidae and Belidae, are mostly known only from *Acacia.* The most abundant species was *Monolepta froggatti* Blackburn, and was found on nine host species.

(d) Phytophagous insects not associated with *Acacia*

Some phytophagous species found are clearly not associated with acacias and are probably of purely casual occurrence. They were all scarce, and included several Chrysomelidae usually found on eucalypts, and aphids.

Not all *Acacia* species supported large numbers of arthropods (Table 1), although the most common orders occurred on all host species examined. Total numbers of taxa found on different species ranged from 9 to 90, and only *Sextius virescens* was found on all possible hosts. Although spiders were found on all *Acacia* spp, no species occurred on more than 15 host

species. In general, the most abundant host trees (*pycnantha, melanoxylon*) yielded more species and individuals than other trees, and there was considerable variation in the fauna of the 'scarcer' tree species.

Discussion

Many of the characteristic faunal elements of acacias in this area had become well-established by the end of this survey, and there appeared to be no phytophagous taxa solely characteristic of, or limited to, juvenile trees. All species found have been captured also on larger trees. In particular, Homoptera and Lepidoptera were present on a wide range of young trees and have the potential to cause substantial damage. However, the young trees (many of which were 'submerged' in surrounding vegetation for much of the period of this survey) are architecturally considerably less complex than mature trees although, with some exceptions, they furnish an equivalent suite of resources. More complex 'architecture' is associated with greater consumer diversity (Lawton 1978, Southwood *et al.* 1979). On acacias, for example, some feeding guilds (flower gallers, seed eaters, many wood borers) are found only on mature or old trees. The early colonisers, however, included a number of relatively specialist taxa which are considerably more host-specific than some of the phytophages found and, for example, the first phyllodes developed on several individual trees were attacked by miners. All, or a large proportion of, the phyllodes of some trees were attacked while still relatively soft, an attack pattern characteristic of many of the *Acacia*-mining Lepidoptera in the area. Psyllidae were also particularly characteristic of flush growth, and were largely absent from fully-expanded phyllodes. The presence of ants attending *Sextius* and other Homoptera indicates that intimate associations between colonising species also develop at an early stage.

In general, however, many of the species found are those also characteristic of older trees, but with some major components of the communities of older trees being considerably less diverse. This applies especially to Lepidoptera and Coleoptera. Many species of these orders found are relatively generalist in that they feed either on a wide range of *Acacia* species or also on other kinds of plants.

There were a few unexpected absences in relation to the known insect fauna of larger trees in the area. Hemerobiidae, for example, were not found, although *Micromus tasmaniae* (Walker) is common on low vegetation in the area and *Drepanacra binocula* (Newman) is particularly characteristic of acacias (New, unpublished). Larvae of the lycaenid butterfly *Jalmenus evagoras* (Donovan) frequently occur on *A. melanoxylon* elsewhere on the campus, but were not found on the seedling trees. Foliage-feeding Chrysomelidae, some of which may occur in enormous numbers on acacias (Elliott 1978: *Pyrgoides orphana* (Erichson) on *A. dealbata* in Tasmania), were largely absent, and none occurred in large numbers.

As Lawton (1978) has emphasised, the seasonal distribution of the insect species associated with a plant is very different from the total number

of species found, and the number of phytophagous species may vary markedly with season. In this survey, phenological differences are largely obscured by the low and sporadic incidence of many species. The more common phytophages have been studied also on larger trees and some have a clear seasonal pattern (New 1979 and unpublished). In general, the incidence on young trees of the more common Homoptera, Coleoptera and Lepidoptera occurred within the predictable 'active periods' on older trees.

Acacias may form dense groups, but even isolated trees can support many arthropod species, and large populations of some of these. Davis (1975) recognised four inter-related factors relevant to the study of such 'host-plant islands', namely size and isolation of the habitat, colonising ability of the animals, and time. In this study, the colonists found have nearly all been found in nearby (to several hundred metres) source populations. Many of the spiders are non-specific to acacias and are widespread in the area. The major limitation to the numbers of species found appears to be time and numbers/'complexity' of plants: the more numerous species of *Acacia*, effectively increasing the 'island size', supported more species of colonisers over the period of this survey.

As many of the inhabitants of acacias of all ages became established on young trees during this survey period, it is implied that many characteristic elements of the insect communities of these trees may persist over much of the life of their host plants.

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